

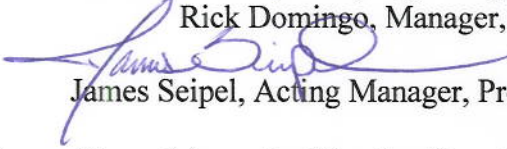


Federal Aviation Administration

Memorandum

Date: NOV 15 2011

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THRU: Christopher Spangenberg, Manager, Seattle Manufacturing Inspection Office
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Prepared by: Airworthiness Certification Branch, AIR-230

Subject: Mig-29 Considerations for Airworthiness Certification

Background

Vulcan Warbirds, Inc. (Applicant) is applying for an experimental exhibition airworthiness certificate to operate N29UB (Mig-29 aircraft) in the Seattle area. The Applicant wants to base the aircraft at Boeing Field. As provided in FAA Order 8130.2G *Airworthiness Certification of Aircraft and Related Products*, Chapter 4, paragraph 4113, and the AIR-200 August 2011 Memorandum concerning former military aircraft, AIR-230 has prepared this memorandum to assist with the airworthiness review of the aircraft and its proposed operations. This memorandum was coordinated with the Flight Standards Service's Aircraft Maintenance and General Aviation and Commercial Divisions.

The authority for this action is 14 CFR§ 91.319 (b) (2), 14 CFR § 91.319 (i), 14 CFR § 21.193 (c), FAA Order 8130.2 paragraph 4113a, and AIR-200 August 18, 2011 Memorandum.

Mig-29 Safety Issues

Attachment 1 contains the safety issues identified concerning the Mig-29 aircraft. These issues are presented for your consideration as part of the airworthiness certification of N29UB and other Mig-29 aircraft. The issues identified in Attachment 1 were not known when the aircraft was first certificated, which may require reconsideration of the original airworthiness certificate issuance.

If you have any questions, please contact the Airworthiness Certification Branch, AIR-230, at (202) 385-6346.

Attachment 1

A. Issues and Possible Mitigation

Mechanical/Aircraft

- On condition alternatives to life-limits should not be considered.
- Recommend proper support documentation be provided in English. The manuals should be from the armed forces of a NATO member state.
- The Mig-29 has a history of vertical stabilizer failures. The aircraft inspection program (AIP) should contain specific vertical tail inspections with emphasis on (1) the magnesium components in the tail assembly and (2) composites materials failure and deterioration. Note: Polish Air Force uses optic, ultrasound and resonance inspection techniques to address this last item.
- The Mig-29 is prone to cracks in the fuselage and wings (attach points). Procedures should be incorporated into the AIP.
- The Mig-29 may have untested structural/aerodynamic problems with wing mounted external fuel tanks. Recommend no stores. Fixed (non-jettisonable) centerline fuel tank only.
- The Mig-29 has a history of in-flight canopy failures and windshields delaminating on the first generation aircraft. Procedures should be incorporated into the AIP.
- RD-33 Series 1 engine has TBO of 350 hours and a life-limit of 600 hours. Consider inspections at 100 hours and possibly at 50 hours on critical components. Generally cracks in the blades and burner can failures are the biggest problem with RD-33. De-rating may be used as well.
- Engine Oil Sampling at 100/150 hour level maintenance inspections may be appropriate.
- The engine air intake systems are prone to foreign object damage and should be addressed in the pre-flight inspection procedures.
- Recommend critical systems such as batteries, GTDE-117 APU, electrical system malfunctions, fire extinguisher system, hydraulic system (i.e., flush lines, pressure tests), and life-support equipment are included in the AIP.
- Recommend conducting inspection cycle on the aircraft every 60 days using the on-board built in test (BIT) system and a visual inspection of appropriate systems.
- Consider conducting a 100 hour, a 200 hour, a 300 hour a 400 hour check (Operational Maintenance Categorization) as outlined by the manufacturer (MiG/RAC).
- As part of the aircraft's AIP, recommend addressing extended time of inactivity/storage (i.e., 31 days as per USAF requirements), such as maintenance (ground checks) and appropriate functionality flight checks (FCF).
- Maintenance and inspection of the K-36 ejection seat should be performed by trained and qualified personnel. The maintenance and inspection should be accomplished with proper equipment and guidance materials using the manufacturer's program and/or NATO acceptable standards. Recommend these procedures be incorporated into the AIP. A good reference concerning ejection seats is NZ CAA AC 43-21 *Escape and Egress Systems*, 25, December 1997.
- Verify exterior lighting meets 14 CFR part 91 requirements, i.e., adequate position and anti-collision lighting.
- Check that the pitot/static system and external lighting meet 14 CFR part 91 requirements.

Operational

- Recommend prohibiting operations over densely populated areas.
- Recommend VMC day only operations.
- Recommend that the operator ensure that (1) no person be permitted to sit on armed ejection seat unless properly trained and (2) provide security during the exhibition of the aircraft to prevent inadvertent activation of the ejection system from inside or outside the aircraft by spectators.
- Recommend the following: minimum display airspeed of $V_{mc} + 25$ ($175 + 25 = 200$ knots). No low speed/high AOA passes by the crowd.
- Recommend restricting operations to a maximum of .8 Mach.
- All flight operations should be coordinated with aircraft rescue fire fighting personnel at any airport of landing (i.e., safety briefing – ejection seat system).
- Prior coordination with ATC should be conducted for operations that may conflict with normal flow of traffic and to accommodate avoiding flight over densely populated areas.
- Two pilots are required for flight. The pilot in command (PIC) and second-in-command (SIC) of this aircraft must hold an airplane category and multi-engine class rating and have a minimum amount of flight time and experience in a similar military type of aircraft, i.e., F-18 and a total of 500 hours in that type of aircraft (1,000 hours if no prior military high-performance training). Proficiency and currency should be 3-5 hours per month.
- Prohibit operations with AOA, pitch or yaw limiters, and G-Limiter INOP, disengaged or over-ridden.
- Aircraft is restricted to altitude below RVSM.
- Incorporate limitations from a NATO aircraft flight manual such as section 5 from the German Air Force technical order.

B. Additional Comments and Details Concerning N29UB Original Operating Limitations

The following operating limitations were revised to address the safety issues as provided in FAA Order 8130.2G, paragraph 4113a. This list is not to be taken as comprehensive and definitive changes and additions to the operating limitations. Additional detail, more specific language, and addition limitations may be necessary as the issues are mitigated for the specific aircraft, its condition, and operational environment. These limitations were coordinated with AFS-800 as required in the order:

- Limitation 4 should read: Minimum Crew For all flights: 2 persons (pilot and co-pilot) as required by 14 CFR § 91.531. The PIC must hold airplane multiengine land (unrestricted multiengine), instrument airplane, and an Authorization issued by the FAA in the form of a temporary LOA (for training and checks) or an authorization on the pilot certificate for the MIG-29. The SIC must hold airplane multiengine land (unrestricted multiengine) and instrument airplane. This aircraft is not eligible for operations for compensation under § 91.319(h).
- Limitation 7 should read: The SIC required by limitation (4) must hold the appropriate airmen certificate and meet the qualification, training and currency of experience requirements of 14 CFR Part 61.
- Limitation 9: Delete last sentence. (4) Requires crew of two.
- Limitation 21: Delete because of (4).
- Limitation 35: The ejection seats must be clearly externally marked to ensure that emergency personnel are aware of the hazard presented by the system. In addition, the ejection seat

system must be secured in accordance with the manufacture's or NATO operation instructions to prevent inadvertent operation of the system any time while aircraft is parked. No person may sit on an ejection seat unless properly trained on the use.

- Limitation 40 should read: Flight at speed greater than .8 Mach is prohibited.
- Add Limitation 46: Aircraft is restricted to altitude below RVSM airspace.
- Add Limitation 47: Minimum speed for display at an aviation event is $V_{mc} + 25$ (175 + 25=200 kts).
- Add Limitation 48: Operation of the aircraft with the EKTRAN system/BIT (on-board built in test system), stability augmentation system, yaw damper, g limiter or AOA limiter inoperative or over-riden is prohibited.
- Add Limitation 49: Maintenance and inspection of the K-36 ejection seat must be performed in accordance with the manufacturer's procedures or US/NATO applicable technical orders.

C. Review Previous Actions with the Following Considerations

- Review engineering data (e.g., DER) for all parts that were fabricated by the restorer by "making mirror copies from the other side of the aircraft..." For example, the original steel attach points for the vertical stabilizers may have been replaced with aluminum without any engineering studies or material analysis. Inquire on spare parts availability.
- Review of the submitted maintenance manual for N29UB by the FSDO and revise the AIP as needed based on the identified issues.
- Request a new program letter from the applicant. For example, the current letter cites proficiency flying, training events, as well as general operations. The last two are examples of operating contrary to the purpose of the airworthiness certificate.
- The Phase I flight testing should be more detailed and extensive protocol with a minimum of 25 hours. The applicant should establish an appropriate level of reliability for the aircraft prior to conducting Phase II operations. To address the aircraft complexities, consider a structured flight test protocol checking all systems (i.e., fuel, flight control, hydraulic, pneumatic, power plant and electrical systems) in a manner similar to the processes that the USAF, US Navy or NATO use. A good reference for this is the USAF T.O. 1-1-300 *Maintenance Operational Checks and Flight Checks*.
- Boeing Field should not be authorized as an option. Paine Field a possibility with northbound departures and southbound arrivals.
- Review customs/importation and ATF documentation for the aircraft. If N29UB was not imported as an aircraft, or if the aircraft configuration is not as stated in the ATF-6, it is not eligible for an airworthiness certificate.
- Ensure that the aircraft has been adequately demilitarized.